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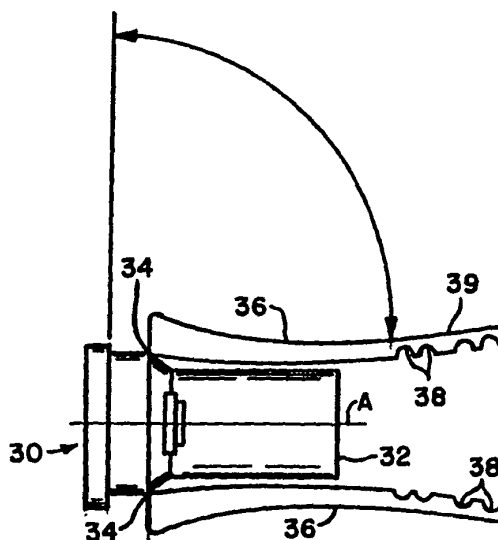
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : B60T 13/569, B29C 69/00 // B29C 65/08</p>	<p>A1</p>	<p>(11) International Publication Number: WO 91/08132 (43) International Publication Date: 13 June 1991 (13.06.91)</p>
<p>(21) International Application Number: PCT/US90/06364 (22) International Filing Date: 1 November 1990 (01.11.90) (30) Priority data: 440,848 24 November 1989 (24.11.89) US (71) Applicant: ALLIED-SIGNAL INC. [US/US]; Law Department (C.A. McNally), P.O. Box 2245R, Morristown, NJ 07962-2245 (US). (72) Inventor: WILKINSON, Dennis, William ; 101 Scenic View Drive, Niles, MI 49120 (US). (74) Agent: ROONEY, Gerard, P.; Allied-Signal Inc., Law Department (C.A. McNally), P.O. Box 2245R, Morristown, NJ 07962-2245 (US).</p>	<p>(81) Designated States: AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH (European patent), CM (OAPI patent), DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GA (OAPI patent), GB (European patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL (European patent), NO, RO, SD, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent). Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>	

(54) Title: COMBINATION DIAPHRAGM AND VALVE BODY



(57) Abstract

The combination diaphragm and valve body comprises a plastic vacuum booster valve body (32) which has molded integrally therewith via living hinges (34) a plurality of diaphragm arms (36). The diaphragm arms (36) may be disposed initially in a position substantially parallel to a longitudinal axis (A) of said valve body (32). The diaphragm arms (36) are pivoted to a position substantially orthogonal relative to the longitudinal axis (A) of the valve body (32) and ultrasonically welded to the valve body (32). Each of said diaphragm arms (36) includes a plurality of radial openings (38) at a radial end (39) thereof for receiving a metal connection member (40). The metal connection member (40) is snap-fitted into associated radial openings (38) in the diaphragm arms (36), and a diaphragm (50) is compression molded about the valve body (32) and over the surface of the diaphragm arms (36). The diaphragm arms (36) may be manufactured separately and then welded to the valve body (32).

UNIQUEMENT A TITRE D'INFORMATION

Codes utilisés pour identifier les Etats parties au PCT, sur les pages de couverture des brochures publiant des demandes internationales en vertu du PCT.

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COMBINATION DIAPHRAGM AND VALVE BODY

The present invention relates to a combination diaphragm and valve body, and in particular a combination diaphragm and valve body for use in a vacuum booster assembly.

5 Vacuum boosters have been utilized for many years in automotive vehicles. Typically, the vacuum booster includes a movable piston which comprises at the center thereof a plastic valve body with a surrounding metal diaphragm plate providing support for a flexible or
10 rubber diaphragm member that extends to an interior surface of the vacuum booster casing. To provide such a vacuum booster, the metal diaphragm plate must be attached to the periphery of the valve body and then the resilient or rubber diaphragm member attached to the
15 periphery of the valve body next to the steel diaphragm plate and also attached to the interior periphery of the booster casing. It is highly desirable to eliminate the steel diaphragm plate in order to reduce the weight and cost of the vacuum booster assembly. It is also highly
20 desirable to provide a diaphragm and valve body construction which will be adjustable to various size vacuum booster assemblies while utilizing only one diaphragm construction which may be altered appropriately.

The present invention provides solutions to the
25 above problems by providing a combination diaphragm and valve body, comprising a plurality of diaphragm arms each connected with a longitudinally extending valve body, the diaphragm arms fixed to the valve body in a substantially
30 orthogonal position, connection means for connecting together said diaphragm arms, and a covering member engaging said valve body and disposed on said diaphragm arms in order to provide an annular member covering said diaphragm arms, the covering member extending beyond a radial periphery of said diaphragm arms.

35 One way of carrying out the invention is described in detail below with reference to the drawings which illustrate an embodiment in which:

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Figure 1 is an illustration of a typical prior art valve body with steel diaphragm plate and resilient diaphragm member;

5 Figure 2 is a side view of the combination diaphragm and valve body construction of the present invention;

Figure 3 is an illustration of the combination diaphragm and valve body with the diaphragm arms welded to the valve body and in an orthogonal position; and

10 Figure 4 is an end view of the combination diaphragm and valve body construction.

Figure 1 illustrates a typical prior art valve body, diaphragm plate, and diaphragm construction. The plastic valve body 10 extends along a longitudinal axis and at its radial periphery 12 includes an opening 14 for receiving therein the inner periphery of a resilient diaphragm 20. Valve body radial periphery 12 includes a step 16 which receives the inner periphery of the steel diaphragm plate 18. The resilient diaphragm 20 includes an inner bead 22 received in opening 14, and the diaphragm extends along and covers steel diaphragm plate 18. Diaphragm 20 extends beyond plate 18 to an outer bead 24 which is attached to the interior surface of a booster casing (not shown). The present invention eliminates the need for steel diaphragm plate 18, thereby reducing the weight and cost of a vacuum booster assembly. Additionally, the present invention provides a combination diaphragm and valve body that may be modified and utilized in different booster assemblies.

30 Figure 2 illustrates the combination diaphragm support and valve body indicated generally by reference numeral 30. Combination diaphragm support and valve body 30 includes a valve body 32 which may be plastic or metal and made in accordance with well known prior methods. However, when a plastic valve body 32 is molded, there is molded therewith via living hinges 34 a plurality of diaphragm arms 36. Diaphragm arms 36 may be pivoted about body 32 so that they can be disposed either substantially

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parallel to longitudinal axis A of body 32 or disposed in a position substantially orthogonal relative to body 32. Each arm 36 includes a plurality of radial openings 38 at a radial end 39. The combination valve body 32 and diaphragm arms 36 may be easily and economically shipped when arms 36 are in the parallel position illustrated at Figure 2. When combination valve body 32 and arms 36 is to be assembled, the arms are first rotated or pivoted to the position orthogonal relative to valve body longitudinal axis A as shown in Figure 3. Each of the arms is ultrasonically welded in place so that it is in a fixed position perpendicular relative to longitudinal axis A. Next, a metallic ring or connection member 40 may be snap fitted into associated openings 38 at radial ends of arms 36. Depending on the size of the booster assembly to be manufactured, the ring 40, according to its diameter, may be snap fitted into any one of the four radial openings 38 present at each radial end 39 of an arm 36. If ring 40 is snap fitted into one of the radially inner openings 38, then the radially outer portion of each arm 36 may be simply removed by cutting or any other method suitable for removing the outer portion. Next, a rubber diaphragm or covering member 50 is compression molded onto to the skeletal surface of the diaphragm arms and valve body. The diaphragm 50 fits tightly about the periphery of valve body central portion 33 and extends over the front and rear sides of diaphragm arms 36 to provide a continuous annular diaphragm covering. Diaphragm 50 extends into radial end 52 which is disposed radially outwardly of the radial ends of arms 36. Each arm 36 includes a front side 35 and a rear side 37, and both of these sides may be covered by diaphragm 50 in order to provide a stronger diaphragm assembly. Alternatively, diaphragm 50 may be molded to just one side of the arms 36. Diaphragm 50 may be molded over the exposed portion of ring 40 when both sides are covered. Also, arms 36 may be metal and manufactured separate from a metallic valve body 32 and then welded to body 32 to provide the arms/body subassembly

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illustrated in Figure 3. Thus, the valve body 32 with extended arms 36, snap ring 40 and covering member 50 provide a completed combination diaphragm and valve body sub-assembly which may be utilized in the further assembly of a vacuum booster assembly.

The present invention provides substantial advantages over the typical prior methods for manufacturing vacuum boosters. The combination diaphragm and valve body does not require the use of a steel diaphragm plate, and utilizes less material which reduces costs. Because the diaphragm arms may be folded to a position substantially parallel with the valve body, the subassembly of the diaphragm arms and valve body may be shipped more easily. Finally, the radial dimension of each diaphragm arm may be adjusted according to the size of the vacuum booster assembly by merely removing the portion of each arm which is radially outwardly of the radial opening which receives the connection member. The final subassembly would have less weight and also enables the utilization of one valve body for different sized boosters.

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CLAIMS

1. A combination diaphragm and valve body (30),
comprising a plurality of diaphragm arms (36) each con-
nected with a longitudinally extending valve body (32),
the diaphragm arms (36) fixed to the valve body (32) in a
substantially orthogonal position, connection means (40)
for connecting together said diaphragm arms (36), and a
covering member (50) engaging said valve body (32) and
disposed on said diaphragm arms (36) in order to provide
an annular member (50) covering said diaphragm arms (36),
the covering member (50) extending beyond a radial
periphery of said diaphragm arms (36).
2. The combination diaphragm and valve body
(30) in accordance with claim 1, wherein said diaphragm
arms (36) are ultrasonically welded to said valve body
(32).
3. The combination diaphragm and valve body
(30) in accordance with claim 1, wherein each diaphragm
arm (36) includes oppositely disposed front (35) and rear
(37) sides, the covering member (50) extending over both
the front (35) and rear (37) sides of the diaphragm arms
(36).
4. The combination diaphragm and valve body
(30) in accordance with claim 1, wherein the connection
means (40) comprises a annular metal ring member (40).
5. The combination diaphragm and valve body
(30) in accordance with claim 1, wherein said covering
member (50) comprises a resilient diaphragm (50) for a
vacuum booster.
6. The combination diaphragm and valve body
(30), in accordance with claim 1, wherein each diaphragm
arm (36) includes a plurality of openings (38) near a
radial periphery thereof, the connection means (40) con-
nected with each diaphragm arm (36) by snapfitting into a
respective opening (38) on each diaphragm arm (36).

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7. The combination diaphragm and valve body (30) in accordance with Claim 1, wherein the diaphragm arms (36) are connected with the valve body (32) by means of respective living hinges (34).

5 8. A method for providing a combination diaphragm and valve body (30), comprising the steps of (a) providing a valve body (32) with a plurality of diaphragm arms (36) connected by respective living hinges (34) so that the diaphragm arms (36) may be disposed in a position
10 substantially parallel to a longitudinal axis (A) of said valve body (32), (b) moving said diaphragm arms (36) into a substantially orthogonal position relative to said valve body (32) and fixing said diaphragm arms (36) in said orthogonal position, (c) providing connection means
15 (40) which extends about and connects together said diaphragm arms (36), and (d) providing a covering member (50) which engages said valve body (32) and extends radially outwardly to provide a continuous covering over said diaphragm arms (36) and which extends beyond radial
20 ends of said diaphragm arms (36).

9. The method in accordance with claim 13, further comprising the step of removing a portion of the radial end of each of said diaphragm arms (36) at one of prior to and after providing said connecting means (40)
25 to said arms (36).

10. The method in accordance with claim 8, further comprising the step of providing a plurality of openings (38) in the radial end of each of said diaphragm arms (36), associated openings (38) in the radial ends
30 receiving said connection means (40).

11. A method for providing a combination diaphragm and valve body (30), comprising the steps of (a) providing separately a valve body (32) and a plurality of diaphragm arms (36) that may be disposed in a position
35 substantially orthogonal to a longitudinal axis (A) of said valve body (32), (b) disposing said diaphragm arms (36) in the substantially orthogonal position relative to

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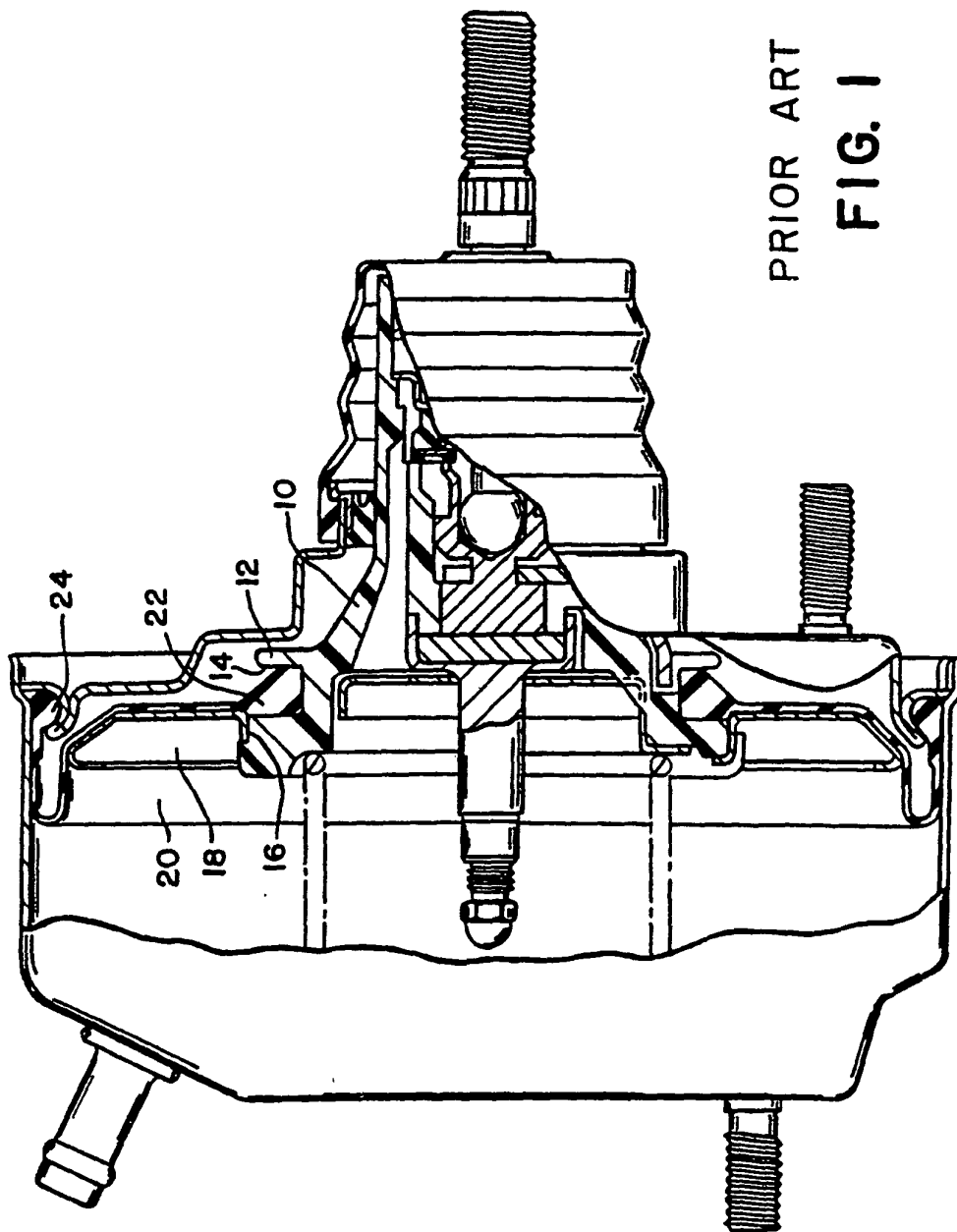
said valve body (32) and fixing said diaphragm arms (36) to said valve body (32), (c) providing connection means (40) which extends about and connects together said diaphragm arms (36), and (d) providing a covering member
5 (50) which engages said valve body (32) and extends radially outwardly to provide a continuous covering (50) over said diaphragm arms (36) and which extends beyond radial ends of said diaphragm arms (36).

12. The method in accordance with claim 11,
10 further comprising the step of removing a portion of the radial end of each of said diaphragm arms (36) at one of prior to and after providing said connecting means (40) to said arms (36).

13. The method in accordance with claim 12,
15 further comprising the step of providing a plurality of openings (38) in the radial end of each of said diaphragm arms (36), associated openings (38) in the radial ends receiving said connection means (40).

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PRIOR ART
FIG. 1

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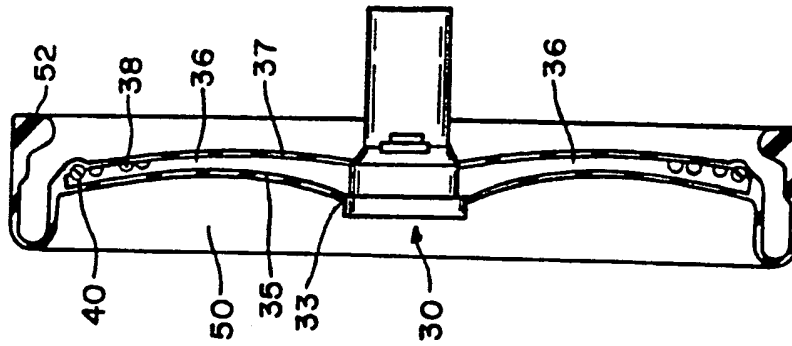


FIG. 3

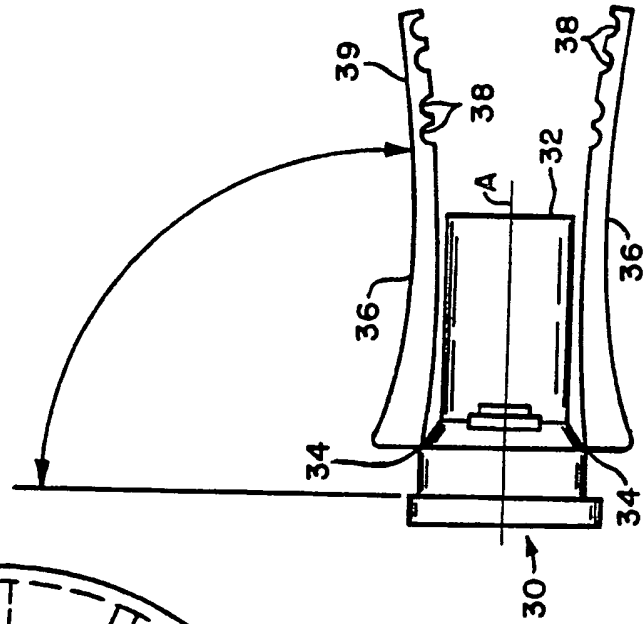


FIG. 2

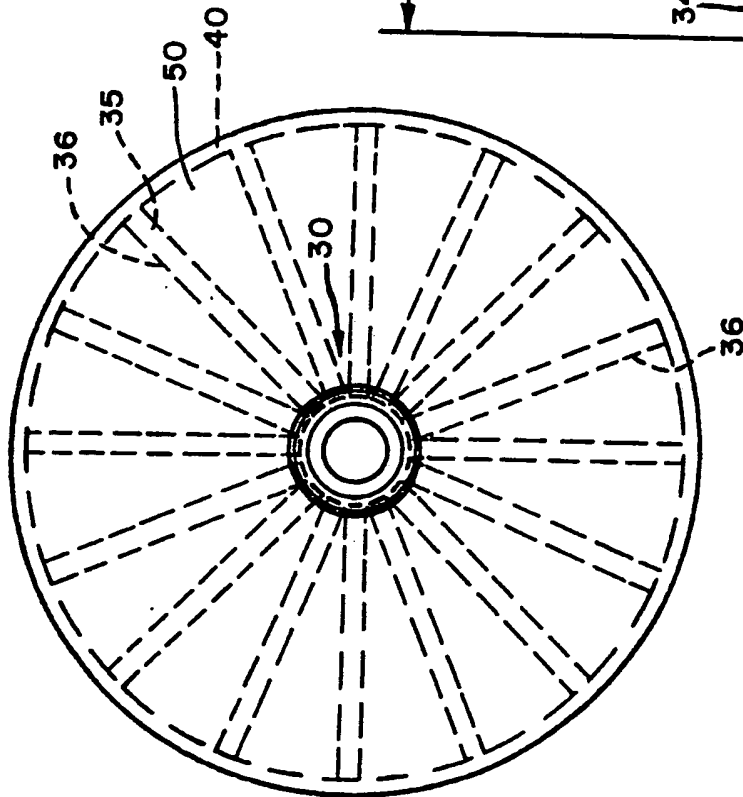


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 90/06364

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁵ : B 60 T 13/569, B 29 C 69/00 // B 29 C 65/08											
II. FIELDS SEARCHED <div style="text-align: right; font-size: small;">Minimum Documentation Searched ?</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%; border: 1px solid black; padding: 5px;">Classification System</td> <td style="border: 1px solid black; padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px; vertical-align: top;">IPC⁵</td> <td style="border: 1px solid black; padding: 5px; vertical-align: top;">B 60 T, B 29 C</td> </tr> </table> <div style="text-align: center; font-size: x-small; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *</div>			Classification System	Classification Symbols	IPC ⁵	B 60 T, B 29 C					
Classification System	Classification Symbols										
IPC ⁵	B 60 T, B 29 C										
III. DOCUMENTS CONSIDERED TO BE RELEVANT[†] <table style="width: 100%; border: none;"> <tr> <th style="width: 10%; border: 1px solid black; font-size: x-small;">Category *</th> <th style="width: 60%; border: 1px solid black; font-size: x-small;">Citation of Document, ^{††} with indication, where appropriate, of the relevant passages ^{†‡}</th> <th style="width: 30%; border: 1px solid black; font-size: x-small;">Relevant to Claim No. ^{‡‡}</th> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top; padding: 10px;">A</td> <td style="border: 1px solid black; padding: 10px;">FR, A, 2149441 (GIRLING) 30 March 1973 page 2, line 33 - page 6, line 17; figures 1-3 ---</td> <td style="border: 1px solid black; text-align: center; vertical-align: top; padding: 10px;">1,4-5</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; vertical-align: top; padding: 10px;">A</td> <td style="border: 1px solid black; padding: 10px;">DE, A, 1555564 (GIRLING) 15 October 1970 see page 4, line 5 - page 9, line 12; figures 1,8 -----</td> <td style="border: 1px solid black; text-align: center; vertical-align: top; padding: 10px;">1,5</td> </tr> </table>			Category *	Citation of Document, ^{††} with indication, where appropriate, of the relevant passages ^{†‡}	Relevant to Claim No. ^{‡‡}	A	FR, A, 2149441 (GIRLING) 30 March 1973 page 2, line 33 - page 6, line 17; figures 1-3 ---	1,4-5	A	DE, A, 1555564 (GIRLING) 15 October 1970 see page 4, line 5 - page 9, line 12; figures 1,8 -----	1,5
Category *	Citation of Document, ^{††} with indication, where appropriate, of the relevant passages ^{†‡}	Relevant to Claim No. ^{‡‡}									
A	FR, A, 2149441 (GIRLING) 30 March 1973 page 2, line 33 - page 6, line 17; figures 1-3 ---	1,4-5									
A	DE, A, 1555564 (GIRLING) 15 October 1970 see page 4, line 5 - page 9, line 12; figures 1,8 -----	1,5									
<div style="display: flex; justify-content: space-between; font-size: x-small;"> <div style="width: 45%;"> <p>* Special categories of cited documents: ^{†§}</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p> </div> </div>											
IV. CERTIFICATION <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search 18th March 1991</td> <td style="width: 50%; border: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report 19. 04. 91</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">International Searching Authority EUROPEAN PATENT OFFICE</td> <td style="border: 1px solid black; padding: 5px;">Signature of Authorized Officer U. TORIBIO</td> </tr> </table>			Date of the Actual Completion of the International Search 18th March 1991	Date of Mailing of this International Search Report 19. 04. 91	International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer U. TORIBIO					
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International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer U. TORIBIO										

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

US 9006364
SA 42730

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 15/04/91. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A- 2149441	30-03-73	GB-A- 1396505	04-06-75
		AU-A- 4505172	21-02-74
		DE-A- 2239667	15-03-73
		US-A- 3851565	03-12-74
DE-A- 1555564	15-10-70	FR-A- 1472864	
		GB-A- 1144566	
		US-A- 3385168	

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